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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/585,759
Filing Date: July 12, 2006
Appellant(s): YAMAZAKI ET AL.

Paul C. Lewis
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 8/25/2010 appealing from the Office action mailed 2/4/2010.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 5-9 stand rejected.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

4382389	**Namiki et al.**	**10-1983**
6,080,199	**Umeyama et al.**	**6-2000**
6,023,989	**Imase et al.**	**2-2000**

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 5-7 and 9, are rejected under 35 U.S.C. 103(a) as being unpatentable over Namiki et al. (USP-4,382,389) in view of Umeyama et al. (USP-6,080,199) further in view of Imase et al (USP-6,023,989).

Re clm 5: Namiki discloses a rack-and-pinion steering apparatus (Figs. 6 and 7) including pinion teeth (67) provided on a circumferential surface of a pinion shaft (65) and rack teeth (66) provided on an outer surface of a rack shaft (63), meshed with each

other substantially without backlash (via 68), so as to transmit rotation of the pinion shaft connected to a steering member (61) to the rack shaft via a mesh portion between the pinion teeth and the rack teeth (Figs. 6 and 7), thus to move the rack shaft in an axial direction thereof at a predetermined stroke ratio for execution of steering operation.

Regarding the limitation, "wherein the pinion teeth are provided with a module m, a number of teeth z, a tooth depth h and a helix angle β that remain within the following respective ranges, under a condition of a pressure angle α being within a range of 24° to 30° and the stroke ratio: module m: 1.8 to 2.0, number of teeth z: 7 to 13, tooth depth h: 2m to 2.5m, helix angle β:40° or smaller " Namiki discloses the claimed invention except for identical ranges for the above values.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have set values for the gear teeth within the respective ranges, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

Additionally, while Nakimi does indeed disclose a pressure angle α being within a range of 24° to 30° (C6 L8-13), and a helix angle β:40° or smaller (C6 L8-13), and what appears to be at least 5 teeth, Nakimi does not explicitly disclose a number of teeth z between 7 and 13, module m of 1.8-2.0, and a tooth depth h of 2m-2.5m.

Umeyama teaches a method of designing a gear, wherein the gear has a number of teeth z between at least 20 and 50 (see Fig. 9) module m of 1.8-2.0, and a tooth depth h of 2m-2.5m (C10 L9-10, C24 L45-49, C27 L61-64) for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (see Abstract and C26 L2-37 explaining optimization of the above parameters).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the number of teeth z, the module m and tooth depth of the pinion of Nakimi such that the number of teeth z is between 7 and 13 (the prior art as a whole teaches a finite range for the number of teeth between 5 and 50), module m is 1.8-2.0 and the tooth depth h is 2m-2.5, as taught by Umeyama, for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (see Abstract and C26 L2-37 explaining optimization of the above parameters).

Additionally, Namiki does not disclose a trochoid interference clearance of the rack teeth and the pinion teeth is positive.

Imase teaches a rack and pinion system (Fig. 1) wherein a trochoid interference clearance of the rack teeth (4) and the pinion teeth (6) is positive (see Figs. 6 and 7 and C5 L64-C6 L14) for the purpose of ensuring proper meshing of the pinion and rack and to reduce gear noise.

It would have been obvious to a person having ordinary skill in the art at the time of the invention to have modified the device of Namiki and Umeyama such that a trochoid interference clearance of the rack teeth and the pinion teeth is positive, as taught by Imase, for the purpose of ensuring proper meshing of the pinion and rack and to reduce gear noise.

Re clms 6 and 7: Nakimi in view of Umeyama disclose all of the claimed subject matter as described above.

Nakimi does not disclose the pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape, and the pinion teeth are subjected to a tooth surface modification of crowning along a tooth trace direction.

Umeyama further teaches pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape, and the pinion teeth are subjected to a tooth surface modification of crowning along a tooth trace direction (Figs. 19, 26-41, C23 L31-C24 L14), for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (Abstract, C23 L31-41).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the tooth surface of the pinion gear of Nakimi suc that the pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape, and the pinion teeth are subjected to a tooth surface modification of crowning along a tooth trace direction, as taught by Umemyama, for the purpose of optimizing the gear to reduce transmission error amplitude thus reducing gear noise (C23 L31-41).

Re clm 9: Namiki in view of Umeyama and Imase disclose all of the claim limitations as described above.

While Imase does indeed teach a positive interference clearance between the rack and pinion, Imase does not explicitly disclose wherein the trochoid interference clearance is 0.3mm or more.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have set the trochoid interference clearance to be 0.3mm or more, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233.

3. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Namiki et al. (USP-4,382,389) in view Umeyama et al. (USP-6,080,199) and Imase et al (USP-6,023,989) further in view of Nakatsu et al. (USP-6,834,742).

Re clm 8: Nakimi does not disclose a motor for steering assistance is disposed between the steering member and the pinion shaft, thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft.

Nakatsu teaches a motor (30) disposed between a steering member (2) and a pinion shaft (6), thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft, for the purpose of achieving the predictable result of providing a steering assist to the driver.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to have included in the device of Nakimi in view of Umeyama, a motor for steering assistance is disposed between the steering member and the pinion shaft, thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft, as taught by Nakatsu, for the purpose of achieving the predictable result of providing a steering assist to the driver.

(10) Response to Argument

Appellant argues that Namiki and Umeyama do not teach a number of teeth z between 7 and 13.

In response, Namiki discloses the pinion has at least 5 teeth as shown in Fig. 7. Umeyama discloses a graph (Fig. 9, z=number of teeth) showing a range for the number of teeth being between at least 20 and 50, and further identifies the number of teeth as a result effective variable (see column 26 lines 18-29, and Fig. 9). The prior art as a whole teaches a finite range for the number of teeth between at least 5 and 50. It would have been obvious to a person having ordinary skill in the art to try a number of teeth between 7 to 13, as a person with ordinary skill has good reason to pursue the known options within his or her technical grasp.

Appellant further argues that the prior art does not identify the number of teeth, the pressure angle, helix angle, tooth depth, and module as result effective variables.

In response, Umeyama describes in column 26 lines 18-29 of the specification under the heading "Novel Method of Designing a Gear", that the design parameters to be taken into account when designing a gear are the tooth number, normal module, tooth depth, pressure angle and helix angle. Additionally, Umeyama discloses in Figs. 9, 21 and 22, the relationship of the above parameters and there influence on gear design. Therefore the prior art does indeed identify the number of teeth, the pressure angle, helix angle, tooth depth, and module as result effective variables.

Appellant argues that one of ordinary skill would not look to Umeyama to modify Namiki to provide the claimed rack and pinion gear because Namiki discloses a

transverse contact ratio less than or equal to 1 whereas Umeyama discloses a contact ratio greater than 1 (e.g. 1.60).

In response, the examiner notes that Applicant is arguing limitations that are not in the claim. Furthermore, Umeyama discloses that the contact ratio may be equal to 1 (see Abstract). Additionally, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Regarding the tooth depth, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Umeyama explicitly discloses a tooth depth of at least 2.5 times the normal module (Column 27 Lines 61-64).

Regarding the limitation “wherein a trochoid interference of the rack and pinion teeth is positive”, Applicant argues that the teachings of Imase would lead one of ordinary skill in the art to replace the teeth of Namiki with rollers.

In response the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the

references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, Imase is cited only for his teaching of shifting the point of contact between the rack and pinion so that a trochoid interference is positive for the purpose of ensuring proper meshing of the pinion and rack and to reduce gear noise (see Figs. 6 and 7 and C5 L64-C6 L14).

Regarding claim 8, Appellant argues that Nakatsu discloses a variable gear ratio mechanism instead of an electric power steering apparatus.

In response, Nakatsu discloses a steering apparatus comprising a controller 20 which controls the operation of a motor 30 which in turn drives the output shaft 6. Thus the controller 20 and motor 30 constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/MATTHEW A JOHNSON/

Examiner, Art Unit 3656

Conferees:

/MJ/ Marc Jimenez

/Richard WL Ridley/

Supervisory Patent Examiner, Art Unit 3656